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Effect Of Genotype On The Growth And Yield Of Pigeonpea [*Cajanus cajan* (L.) Millsp] In Makurdi, Southern Guinea Savanna Of Nigeria

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ABSTRACT

A field experiment was carried out during the cropping seasons of 2012 and 2013 at the Teaching and Research Farm of the University of Agriculture, Makurdi, Benue State, Nigeria. The experiment sought to evaluate the growth and yield of six pigeonpea genotypes in the area. The genotypes used were: ICPL 88039, ICPL 187-1, ICPL 332, ICPL 84060, ICPL 87119 imported from India and 'Igbongbo' (the local check). The experiment was laid out in Randomized Complete Block Design with three replications. Vegetative growth and yield parameters showed variations among genotypes. 'Igbongbo' (local check) produced the highest number of days to first flowering, number of days to maturity, plant height, number of seeds per pod, pod length and 100-seed weight. ICPL 87119 gave the highest number of leaves per plant while ICPL 332 produced the highest pod bearing length. The highest number of branches per plant, number of pods per plant and grain yield was produced by ICPL 187-1. Farmers will likely consider ICPL 187-1for adoption since it gave the highest grain yield. For reasons other than grain yield, the 'Igbongbo' (local check) and or ICPL 87119 should be used but when farmers' preference is early maturity, ICPL 88039 should be considered.

INTRODUCTION

Pigeonpea [*Cajanus cajan* (L.) Millsp] is an important legume crop widely cultivated in tropical and sub-tropical climates of the world (Corie et al., 2012). Egbe and Kalu (2009) had noted that cultivation of pigeonpea was becoming popular in Nigeria. Some of the pigeonpea-growing states in Nigeria include:- Kogi, Benue, Kaduna, Nasarawa, Taraba, Enugu, Federal Capital Territory (FCT) and Ebonyi. In spite of its high yielding potential and numerous uses as food, feed, firewood and shade among many others, its level of production in Nigeria is low compared to India, Kenya, Malawi, Uganda and Tanzania (FAOSTAT, 2009).

Several local varieties of pigeonpea are grown by farmers in Benue State, especially in Apa, Ogbadibo, Agatu, Okpokwu and Otukpo Local Government Areas. Most of these varieties are long duration types that mature between 280-300 days after planting and yield poor by (0.5-1 t/ha) (Egbe, 2005). Some of the varieties found with the farmers have poor cooking qualities, often susceptible to pest and diseases but produce high leaf litter. Some improved genotypes were recently brought into Benue State and grown at Otobi near Otukpo (Egbe and Vange, 2008) and exhibited fairly high grain yields (1.20-2.0 t/ha). Pigeonpea is sparsely grown in Makurdi, but the potential for its production exist in the area. This study was conceived to evaluate some improved pigeonpea genotypes from India for growth and yields in Makurdi environment.

MATERIALS AND METHODS

Experimental Location

A field experiment was carried out during the cropping seasons of 2012 and 2013 at the Teaching and Research Farm of the University of Agriculture, Makurdi [Latitude 07º45' - 07º 50' N, Longtitude 08º 45'- 08º 50' E, elevation 98 meters above sea level] in Benue State, located in Southern Guinea Savanna of Nigeria (Kowal and Knabe, 1972). The experiment sought to evaluate the growth and yield of six pigeonpea genotypes in the area. The experimental site received a total rainfall of 1363.90mm and 1434.30mm in 2012 and 2013 respectively.

Soil Sampling and Analysis

A composite soil sample comprised of eight core samples was collected from different parts of the field from 0-30 cm depth and bulked into a composite sample and used for the determination of the physical and chemical properties of the soil (Table 1) before planting.

Treatment and Experimental Design

The treatments comprised of six pigeonpea genotypes [ICPL 88039, ICPL 187-1, ICPL 332, ICPL 84060, ICPL 87119 (imported from India) and 'Igbongbo' (the local check)] set out in randomized complete block design with three replications. Two separate fallow fields were used for the experiment within the same location to avoid residual effect of fertilizer. The gross plot was 4m x 3m (12m2) while the net plot measured 2m x 3m (6m2). Each gross plot consisted of 4 ridges spaced 1m apart and 3m long.

Agronomic Practices

Land was prepared manually using hoes and cutlasses. Planting was done on the 19th of May, 2012 and 25th May, 2013. Three seeds were planted per hill and spaced 30cm within row. Thinning was done 10 days after planting (DAP). The approximate plant population density for each pigeonpea genotype was 66,666 per ha. All plots received a basal application of 200kg of NPK 15:15:15 (30kg N, 12.90kg P and 24.90kg K) per ha by spot application. All plots were hand weeded at 3 and 6 weeks after planting (WAP).

Data Collection and Analysis

Data was collected on plant height, number of leaves and number of branches at 4, 8, 12 WAP, days to 50% flowering, days to 50% maturity, pod bearing length, number of pods per plant, number of seeds per pod, grain yield and one hundred seed weight.

Year x Treatment interactions were not significant, so data for both years were pooled together and analyzed. Standard procedures were followed in collecting all data and analysis was done using GENSTAT statistical software. Whenever differences between treatment means were significant, means were separated by Fishers Least Significant Difference at 5% level of probability.

RESULT AND DISCUSSION

Total precipitation reported within the period of experimentation was sufficient for growth and development of the crop. The plant height, number of leaves and number of branches of pigeonpea varied with genotype and increased steadily from 4WAP to 12WAP (Figure 1, 2 and 3). The variation in plant height among genotypes was expected as each genotype possessed different genetic make-up. Egbe and Vange (2008) observed that plant height in pigeonpea was affected by maturity duration, photoperiod and environment. The late maturing varieties generally gave higher plant height than medium and early. Reddy (1990) observed that late-maturing long-duration varieties are generally tall, because of their prolonged vegetative phase, while the short-duration or early-maturing varieties are comparatively short in stature due to their short vegetative growth phase. Since all genotypes in this study received the same treatment and were planted within the same environment, differences in maturity duration and genetic make-up could be responsible for this variation in plant height. Data presented in Table 2 showed that 'Igbongbo' and ICPL 88039 produced the highest (123.76) and lowest (55.00) number of days to flowering respectively. Similarly, 'Igbongbo' gave the highest number of days to maturity while ICPL 88039 gave the lowest number of days to maturity (Table 2). It has been reported that the length of the reproductive period in legumes are very variable (Madamba et al., 2006). An observation of the mean values and ranges for days to first flowering and days to first flowering and days to maturity indicated that there was a wide range of variation in the expression of the characters. Pod bearing length was significantly (P≤ 0.05) influenced by genotype. ICPL 332 produced the highest pod bearing length (289.00 cm) of pigeonpea but this was not significantly (P≥0.05) higher than that produced by ICPL 87119 (284.70cm) but was significantly (P≥ 0.05) higher than that produced by any other genotype (Table 2). The superior performance of ICPL 332 over the other genotypes could be due to genetic endowment. The number of pods per plant produced by ICPL 187-1 (362.28) was significantly (P≤ 0.05) higher than that produced by any other genotype except ICPL 332 (323.34) (Table 2). The higher number of pods per plant recorded by ICPL 187-1 and ICPL 332 indicated that these genotypes were more efficient in partitioning photo-assimilates into pods. This result agrees with the findings of Okafor (1986) who also recorded significant (P≥ 0.05) varietal effect on number of pods per plant. The number of seeds per pod produced by 'Igbongbo' (6.00) was statistically at par with that produced by ICPL 187-1(5.27) and significantly higher than that produced by any other genotype. 'Igbongbo' produced significantly higher pod length (5.47cm) than any other genotype (Table 2). The differences in number of seeds per pod and pod length may be attributed to genetic characteristics or genetic make-up. Ugur et al. (2011) also reported variation in number of seeds per pod and pod length among cowpea genotypes. ICPL 187-1 gave the highest grain yield (1.37 t/ha) but this was not significantly (P≤ 0.05) different from that produced by ICPL 332 (1.23 t/ha) but significantly (P≥ 0.05) higher than that produced by any other genotype. The superior performance of ICPL 187-1 suggest that the variety had variable difference in the anatomical, morphological and physiological structure which made it readily able to absorb nutrients and water from the soil, carry out effective photosynthetic process and store photosynthates which other varieties could not do. This observation supports the findings of Agbogidi and Ofuoku (2005) who reported that plants respond differently to environmental factors based on their genetic makeup and their adaptation capability indicating that variability among species. The higher number of branches produced by ICPL187-1 may also be responsible for its higher grain yield compared to other genotypes. Mudaraddi and Saxena (2013) reported that the number of branches among other characters had direct positive effects on the seed yield of 22 CMS-based pigeonpea in India. Medium maturing genotypes generally gave higher grain yields than late and early maturing ones. The observation in this study is consistent with that of Dasbak and Asiegbu (2012) who also found medium maturing pigeonpea genotypes producing higher grain yield than both early and late maturing ones. The 100-seed weight of pigeonpea was significantly (P≤ 0.05) affected by genotype. 'Igbongbo' and ICPL 88039 gave the same 100-seed weight of pigeonpea and this represented the highest 100-seed weight of pigeonpea among the genotypes evaluated (Table 2). Okafor (1986) also reported significant (P≥ 0.05) differences in 100-seed weight among nine cowpea varieties tested in Nigeria.

Table 1: Estimates of different parameters from germination upto reproductive stage in maize inbreds.

Parameters	Value	
	2012	2013
Sand (%)	72.20	73.10
Silt (%)	12.20	11.30
Clay (%)	14.40	13.50
Textural class	Sandy loam	Sandy loam
pH (H_2O)	5.93	6.30
Organic Carbon (%)	0.72	0.80
Organic Matter (%)	1.25	1.36
Total Nitrogen (%)	0.70	0.78
Available Phosphorus (ppm)	3.60	2.90
Cal^{2+} Cmol kg^{-1} soil)	3.41	3.57
Mg^{2+} (Cmol kg^{-1} soil)	1.62	1.70
K^{+}Cmol kg^{-1} soil)	0.29	0.30
Na^{+}Cmol kg^{-1} soil)	0.60	0.52
CEC Cmol kg^{-1} soil)	6.25	6.40
Base Saturation (%)	94.40	95.00

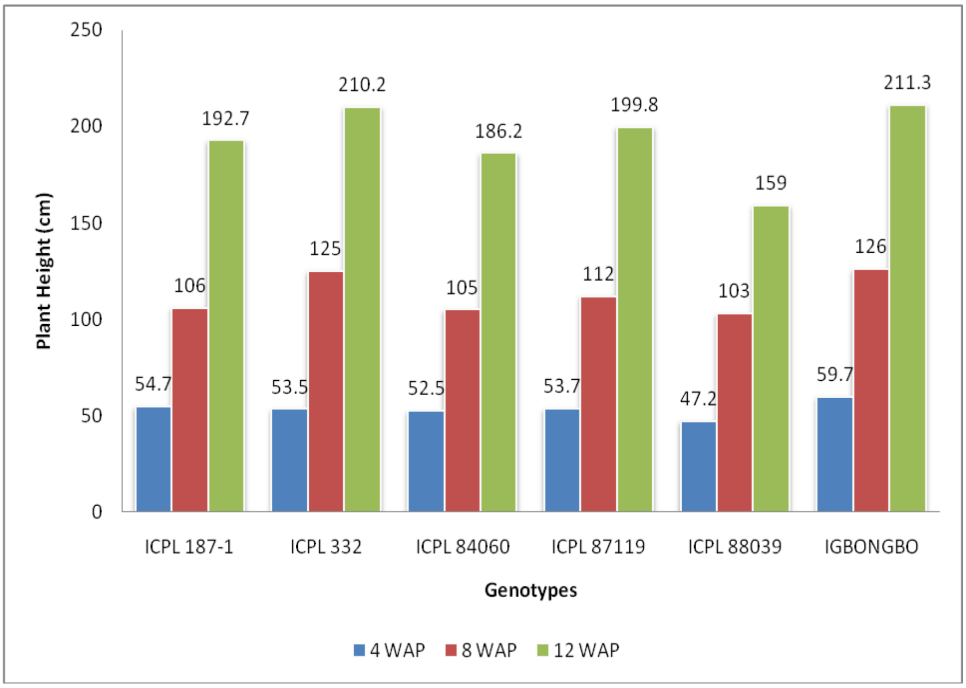

Fig 1: Plant height of pigeonpea at 4, 8 and 12 WAP as influenced by genotype in Makurdi.

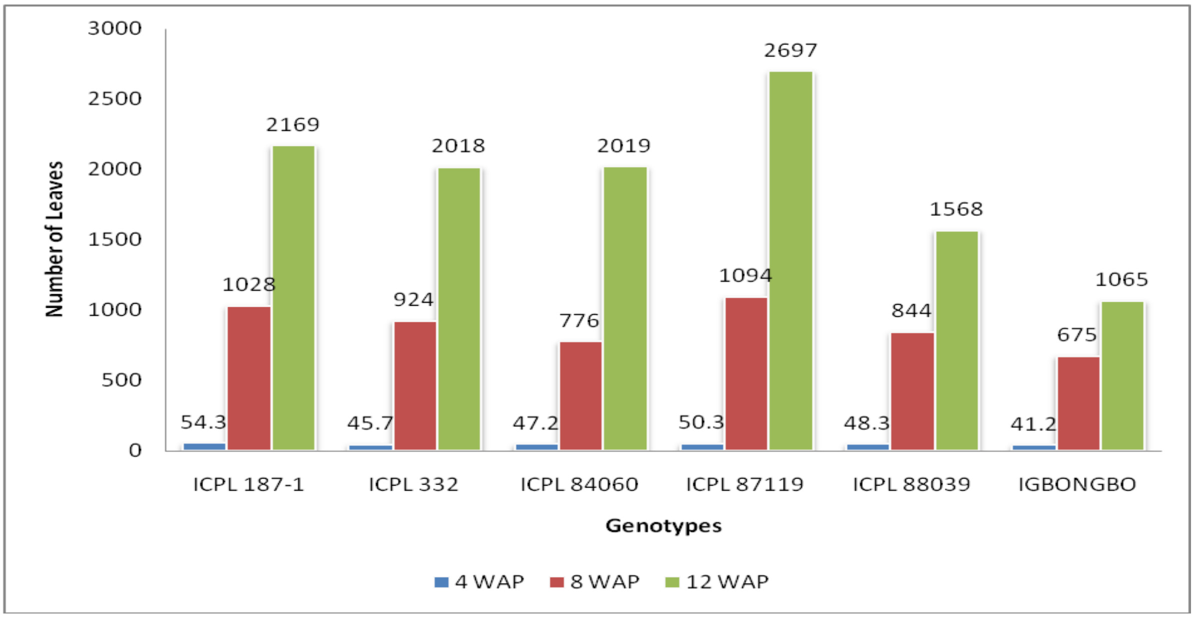

Fig 2: Number of leaves of at 4, 8 and 12 WAP as influenced by genotype in Makurdi.

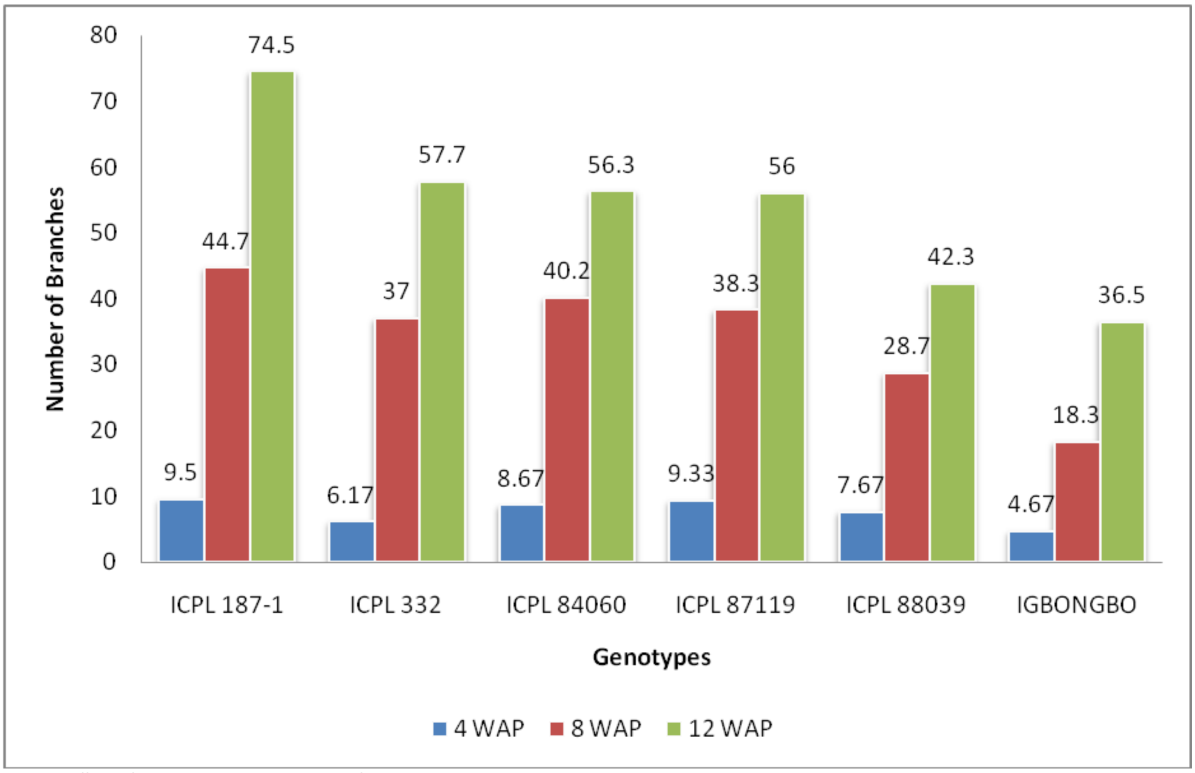

Fig 3: Effect of genotype on the number of branches at 4, 8 and 12 WAP in Makurdi.

Table 2: Days to First Flowering (DF), Days to Maturity (DM), Pod Bearing Length [PBL (cm)], Number of Pods per Plant (NPPP), Number of Seeds per Pod (NSPP), Pod Length [(PL) cm], Grain Yield [(GY) t/ha), and Hundred Seed Weight [(100-SW) g] of Pigeonpea as Influenced by Genotype in Makurdi.

Variety	Maturity Class	DF	DM	PBL	NPPP	NSPP	PL	GY	100-SW
ICPL 88039	E	55.00	105.33	144.70	134.23	4.60	4.44	0.37	9.40
ICPL 84060	M	93.46	182.65	164.10	167.17	4.63	4.51	0.46	10.03
ICPL 187-1	M	88.33	167.87	181.70	362.28	5.27	4.80	1.37	10.60
ICPL 87119	M	98.42	189.76	284.70	188.33	4.27	4.67	0.88	9.93
Mean for M		**93.40**	**180.09**	**210.17**	**239.26**	**4.72**	**4.66**	**0.90**	**10.19**
ICPL 332	L	117.45	224.54	289.00	323.34	4.40	4.50	1.23	9.63
'Igbongbo'	L	123.76	246.76	207.20	102.30	6.00	5.47	0.23	10.70
Mean for L		**120.61**	**235.65**	**248.10**	**212.82**	**5.20**	**4.99**	**0.73**	**10.17**
Grand Mean		**96.07**	**186.15**	**211.90**	**212.94**	**4.86**	**4.73**	**0.80**	**10.05**
FLSD (0.05)		22.43	30.43	27.01	124.50	0.85	0.30	0.57	1.09

Key: E: Early; M: Meduim; L: Late

CONCLUSION

Six pigeonpea genotypes were tested in Makurdi for growth and yield. The pigeonpea genotypes varied in plant height, number of leaves, number of branches, days to 50% flowering, days to 50% maturity, pod bearing length, number of pods per plant, number of seeds per pod, grain yield and one hundred seed weight. Grain yield was observed to be low (0.37t/ha -1.37t/ha) compared to other locations. Aloyce et al. (2015) reported yields of 1410kg/ha to 2073kg/ha in Southern Tanzania. This was probably due to minimal use of insect pest management technology or some other crop management practices. Medium maturing pigeonpea genotypes gave higher grain yield than late and early maturing genotypes respectively.

Disclosure statement

No potential conflict of interest was reported by the author.

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